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First records of *Anthidium florentinum* (Hymenoptera, Megachilidae) in the Canary Islands: insights on citizen science and exotic bee species

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Abstract

In recent years, the development of biodiversity inventorying platforms has contributed to the detection of exotic species, bringing awareness to the general public about their impact on native habitats. This is important in the Canary Islands and other oceanic archipelagos, where invasive species pose a great risk to the conservation of ecosystems and biodiversity monitoring strategies may not be completely adequate in their detection. Here we report for the first time the occurrence of the Florentine wool carder bee, *Anthidium florentinum*, in the Canary Islands and address its current distribution in the islands of Tenerife and Gran Canaria with the help of citizen science. Other bee species recently reported as new to the archipelago through the use of iNaturalist are summarized. The possible effects of *A. florentinum* on native bee communities in the archipelago, along with the role of cities in hosting biological invasions are also discussed.

Keywords

Alien species, early detections, oceanic islands, social media, wood-nesting bees

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Introduction

Invasive bees are responsible for several negative impacts such as competition for floral and nesting resources, disruption of pollination networks, and introduction of pathogens (Russo 2016). In oceanic islands, native pollinators in most cases have evolved in isolation from the mainland, which makes them especially sensitive to the advent of alien species, owing to a lack of advanced competitive strategies against continental newcomers (Sugiura 2016).

Wood-nesting bee species (particularly many megachilid species from the genera *Anthidium* Fabricius, 1804 and *Megachile* Latreille, 1802) are especially prone to accidental transport by trade, which makes them the most common introduced and invasive species (Russo 2016). In the Canary Islands, several wood-nesting species have been introduced in the last decades, such as the megachilid bees *Anthidium manicatum* (Linnaeus, 1758) (Lieftinck, 1958) and *Megachile otomita* Cresson, 1878 (Strudwick and Jacobi 2018), the carpenter bees *Xylocopa violacea* (Linnaeus, 1758) (Ortiz-Sánchez et al. 2016) and *X. pubescens* Spinola, 1838 (Ruiz et al. 2020), and various *Hylaeus* Fabricius, 1793 species (Lugo et al. 2022).

One wood-nesting species that has also been accidentally introduced is the Florentine wool carder bee *Anthidium florentinum* (Fabricius, 1775). This species has a natural distribution extending from South and Central Europe (Amiet et al. 2004) to China (Niu et al. 2020), and also includes several mediterranean islands such as Malta (Balzan et al. 2017), the Balearic Islands (Baldock et al. 2020), and Cyprus (Varnava et al. 2020). In recent decades, this species has expanded northward beyond its historic range limits (Fig. 1) to reach Switzerland (Kouakou et al. 2008), Slovenia (Gogala 2012), Austria (Zettel et al. 2016), Germany (Schwenninger 2008) and Russia (Antropov et al. 2017) including the Moscow area and a disjunct population as far north as St. Petersburg (reflectitur_photons Obs. https://www.inaturalist.org/observations/14364056). *A. florentinum* has also been reported from Algeria (Aguib et al. 2010) and very recently in India (Sardar et al. 2022). Additionally, this species has been recently introduced in North America, as it was observed in eastern Canada from the Montreal area (Normandin et al. 2017) and in the Eastern USA very locally in far Northern New York State just south of the Quebec border (joshualincoln Obs. https://www.inaturalist.org/observations/93793337).

A. florentinum is a polylectic and univoltine species with a flying period that starts early in June and ends in late August, overlapping for both males and females (Fortunato et al. 2013). Males carry out a mating system called resource defense polygyny in which they patrol and defend flower patches of different plant families potentially attractive to female foragers, particularly Fabaceae and Lamiaceae (Romero et al. 2021). They show a very aggressive behavior, attacking other conspecific males, and also different species of pollinators, in order to keep intruders away from the area they are securing, to ensure reproductive success (Wirtz et al. 1992).

Anthidium florentinum can be easily mistaken for *A. manicatum*, a common and widespread species that has similar overall appearance, size and colouration, but with

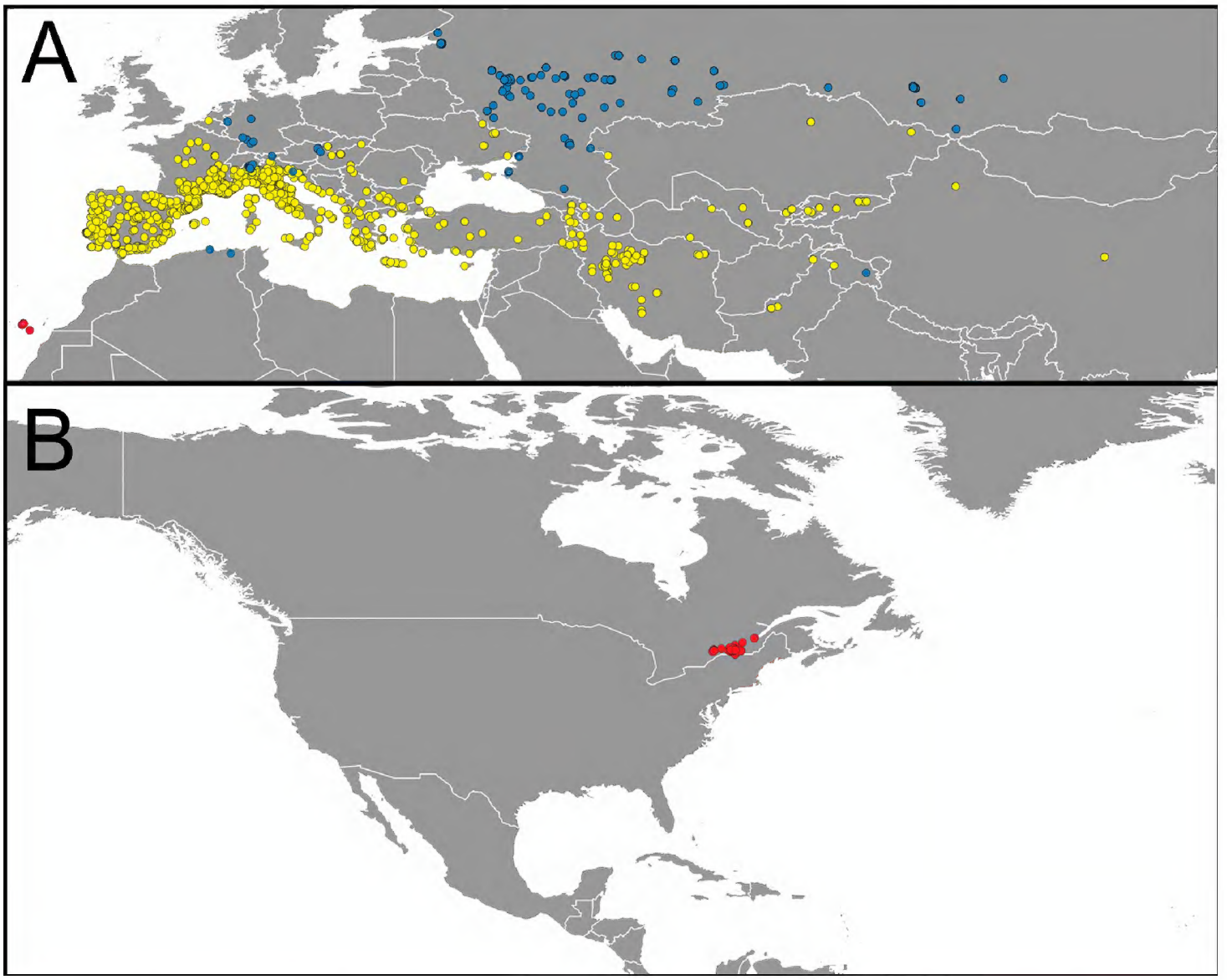

Figure 1. Range of distribution of *Anthidium florentinum* based on georeferenced records (dots) obtained from GBIF 2024 (https://www.gbif.org/). Countries within the natural range of distribution of *A. florentinum* are marked with yellow dots. Countries near its native range where this species has been detected in the last decades are marked with blue dots. Regions where *A. florentinum* has been recently introduced are marked with red dots **A** Eurasia and North Africa **B** North America.

subtle differences. For instance, males of both species can be differentiated by looking at the fourth and fifth abdominal tergites, where *A. florentinum* shows a lateral tooth at both sides of these segments, whereas *A. manicatum* only has this trait at tergite 5. Also, *A. manicatum* usually displays a black stain in the upper part of the clypeus in both sexes, whereas *A. florentinum* doesn't. Differences in coloration patterns are useful provided that considerable geographic and individual variation in both species is accounted for.

In this issue we report the occurrence of *A. florentinum* in the islands of Tenerife and Gran Canaria, and discuss the current distribution of this new bee species in the archipelago, as well as the potential threat that this exotic species may represent for native communities of pollinators in the Canary Islands. Additionally, we comment on the role of citizen science in monitoring exotic species, and note its contribution to new discoveries and to a deeper understanding on the spatial distribution of species.

Methods

In May of 2022 two specimens in an urban park of Santa Cruz de Tenerife city were misidentified as *A. manicatum* on iNaturalist (iNaturalist 2024) as it was the only known *Anthidium* in the island. The observation was later identified as *A. florentinum* by one of us (JSA) via iNaturalist later in the year. An active search with nets was performed in different areas of the enclosure where flowering plants were abundant. In addition, we searched for observations submitted by users in social media platforms like Facebook, X, Instagram and iNaturalist (https://www.inaturalist.org.) to have a broader view of the distribution of *A. florentinum* in the Canary Islands. For the same purpose, the bee collection of the Zoology Department of the University of La Laguna was examined.

Results

Several specimens of *A. florentinum* were either collected by net or uploaded as observations in iNaturalist by users in different localities on the islands of Tenerife and Gran Canaria.

Collected specimens

Spain. Canary Islands, **Tenerife**, Santa Cruz de Tenerife. 1 ♂; Parque García-Sanabria; 28.4715, -16.2543; 12 Jun. 2022; D. Patiño leg. • 3 ♂♂, 3 ♀♀; Parque García-Sanabria; 28.4715, -16.2543; 12 Aug. 2022; D. Patiño leg.

Records obtained from citizen science

Spain. Canary Islands, **Tenerife**. 1 ♂, 1 ♀; Santa Cruz de Tenerife; 28.4729, -16.2543; 30 May 2022; D. Patiño, pers. obs. (https://www.inaturalist.org/observations/119402491) • 1 ♀; Arafo; 28.3428, -16.4353; 29 Jun. 2022; Gustavo Peña, pers. obs. (https://www.inaturalist.org/observations/125579345) • 1 ♀; Arafo; 28.3428, -16.4353; 10 Aug. 2022; Gustavo Peña, pers. obs. (https://www.inaturalist.org/observations/130412080) • 1 ♀; San Cristóbal de La Laguna; 28.4930, -16.3162; 13 May 2023; carmendgq, pers. obs. (https://www.inaturalist.org/observations/161777634) • 1 ♂; Santa Cruz de Tenerife; 28.4521, -16.2564; 27 May 2023; fer_guerra, pers. obs. (https://www.inaturalist.org/observations/164070022) • 1 ♂; Santa Cruz de Tenerife; 28.4518, -16.2564; 27 May 2023; fer_guerra, pers. obs. (https://www.inaturalist.org/observations/164070949) • 1 ♀; San Cristóbal de La Laguna; 28.4953, -16.3227; Aug. 2023; sus_scrofa, pers. obs. (https://www.inaturalist.org/observations/187140681) • 1 ♀; San Cristóbal de La Laguna; 28.5111, -16.3247; 21 Sep. 2023; Domingo Sosa, pers. obs. (https://www.inaturalist.org/observations/184420785) • 1 ♀; Santa Cruz de Tenerife; 28.4715, -16.2543; 3 Oct. 2023; D. Patiño, pers. obs. (https://www.inaturalist.org/observations/186158783) • 1 ♂; San Cristóbal de La Laguna; 28.4803, -16.3199; 12 Jun. 2024; nestork66,

pers. obs. (https://www.inaturalist.org/observations/222221473) • 1 ♀; Arafo, 28.3428, -16.4317; 13 Jul. 2024; wormsy, pers. obs. (https://www.inaturalist.org/observations/228988344) • 1 ♀; Santa Cruz de Tenerife; 28.4721, -16.2551; 11 Jul. 2024; skipshoemaker, pers. obs. (https://www.inaturalist.org/observations/231008324) • 1 ♀; Santa Cruz de Tenerife; 28.4639, -16.2730; 8 Sep. 2024; victor_febles, pers. obs. (https://www.inaturalist.org/observations/240903947).

Spain. Canary Islands, **Gran Canaria**. 1 ♀; Maspalomas; 27.7420, -15.6000; 14 May 2023; alexsim123, pers. obs. (https://www.inaturalist.org/observations/161581870).

Discussion

Different observations obtained through citizen science in Gran Canaria and Tenerife, along with collected samples, confirm the presence of *A. florentinum* in the Canary Islands (Fig. 2).

Regarding the reproductive strategy of *A. florentinum*, resource defense polygyny is also displayed by males of sister species *A. manicatum* (Seidelmann 2021), arguably the most widespread unmanaged bee species globally (Strange et al. 2011). Different interactions between *A. manicatum* and native species of bees have been studied in regions beyond its native range, and some cases of resource competition (Soper and Beggs 2013) and exclusion (Graham et al. 2019) have been documented. Nonetheless, whether the arrival of *A. florentinum* to new territories poses the same threat for indigenous species is still uncertain, and further studies are needed to evaluate the impact of its introduction on native bee populations in the Canary Islands.

A. florentinum's generalist diet and its tendency to nest in pre-existing cavities enable this species to be easily transported for long distances, and eases its establishment in urban areas. Cities can host diverse communities of wild bee species, but they may also act as hotspots for biological invasions by allowing the accidental introduction of alien species, which in some cases leads to the biotic homogenization of urban communities of native bees, biodiversity loss, and the spread of exotic species into surrounding natural landscapes (Fitch et al. 2019). In this matter, the role of citizen science is crucial for the early detection and surveillance of invasive alien species, enabling public awareness on biological invasions and their negative impact on native biota (Roy et al. 2023).

Ever since the development of biodiversity monitoring platforms like iNaturalist and Observation.org, among others, volunteers can easily share georeferenced data of different taxa, based on observations, with the scientific community (Howard et al. 2022). Moreover, people with relevant expertise like taxonomists can also contribute by giving a more accurate identification to such records, therefore enhancing their taxonomic level and research quality (Callaghan et al. 2022). This is important because users that are less experienced at recognizing certain species or groups can sometimes fail in the identification process, as was the case with *A. florentinum* being initially mistaken for *A. manicatum*.

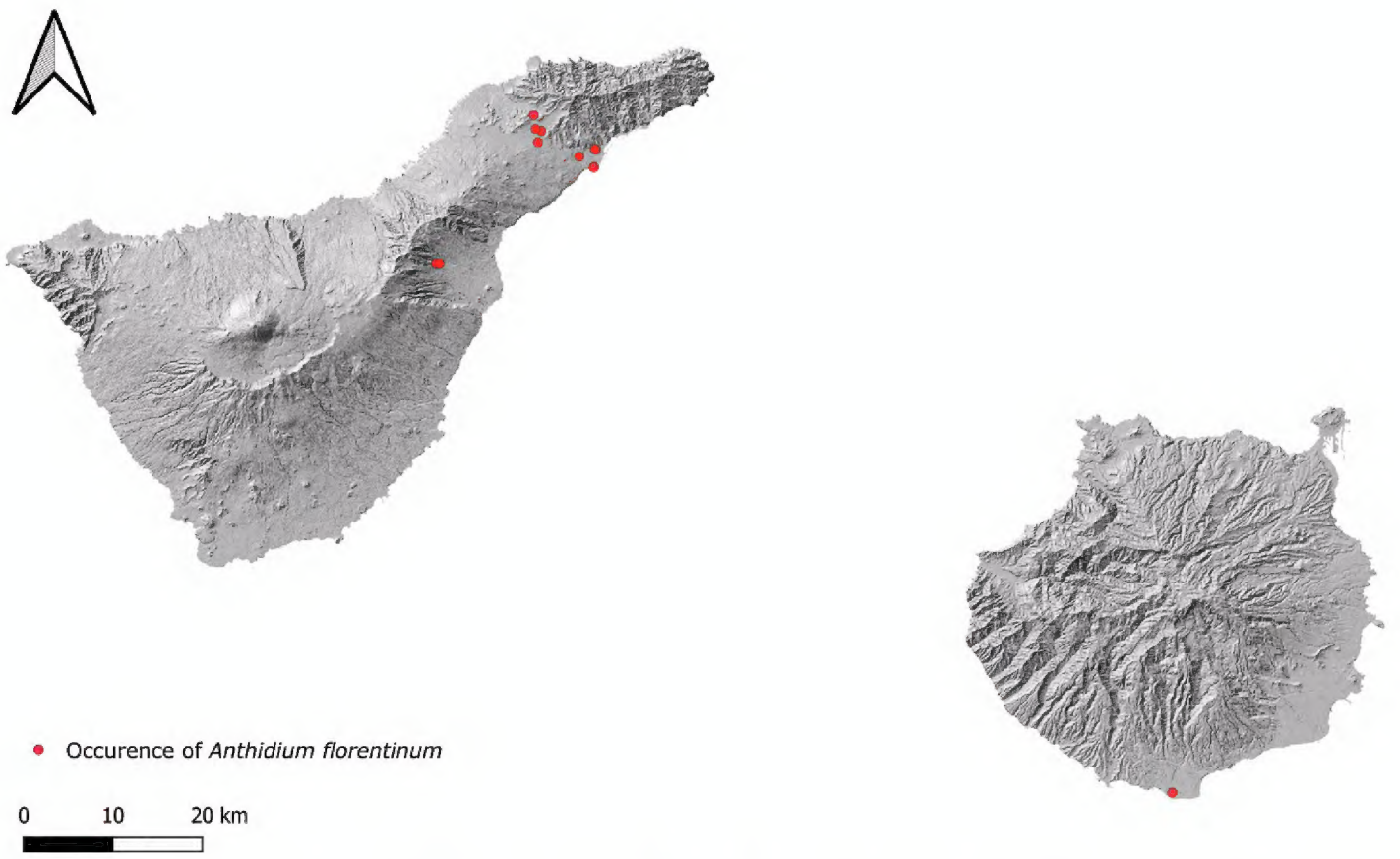

Figure 2. Localities where *A. florentinum* has been observed (red dots) in the islands of Tenerife and Gran Canaria.

This recent growing synergy between citizen scientists and experts has so far led to an increase of the knowledge about species' geographical distribution, and even to the rediscovery of species thought to be extinct or locally extirpated, new descriptions, and the early detection of alien species (Callaghan et al. 2022), that allows effective and cost-affordable fast management responses, as established populations are much more difficult and expensive to control (Roy et al. 2023). In the Canary Islands, the use of iNaturalist has proven to be useful for the discovery of new bee species such as the recently described *Pseudoanthidium jacobii* Vereecken & Litman, 2023, endemic to Fuerteventura and Lanzarote (Vereecken et al. 2023), and several exotic species besides *A. florentinum*, such as *Lasioglossum malachurum* (Kirby, 1802) in Tenerife (Domingo Sosa Obs. https://www.inaturalist.org/observations/124150514) and *Seladonia gemmea* (Dours, 1872) in Gran Canaria (biofreak Obs. https://www.inaturalist.org/observations/137972057).

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